

III.B.2 Geometric Buckling FormulasShape B_g^3

Infinite Slab:

$$\frac{\pi^2}{(a + 2\lambda)^2}$$

a = width of finite side
 λ^1 = extrapolation distance

Parallelepiped:

$$\pi^2 \left[\frac{1}{(a + 2\lambda)^2} + \frac{1}{(b + 2\lambda)^2} + \frac{1}{(c + 2\lambda)^2} \right] \quad a, b, c \text{ edges}$$

Infinite Cylinder:³

$$\frac{2.405^2}{(r + \lambda)^2}$$

 r = cylinder radius

Finite Cylinder:

$$\frac{2.405^2}{(r + \lambda)^2} + \frac{\pi^2}{(h + 2\lambda)^2}$$

r = cylinder radius
 h = cylinder height

Infinite Hemicylinder^{2, 3, 4}

$$\frac{(3.832)^2}{(r + \lambda)^2}$$

 r = hemicylinder radiusSphere:⁴

$$\frac{\pi^2}{(r + \lambda)^2}$$

 r = sphere radius

Hemisphere:

$$\frac{(4.49)^2}{(r + \lambda)^2}$$

 r = hemisphere radius

¹ λ depends upon the fissile material, the geometry and the systems surroundings.

² For a sector of a cylinder, see Page II.B.2-3.

³ Critical cylinders and hemicylinders are related by:

$$r_{hc} = 1.5935r_{cyl} + 0.5935\lambda$$

⁴ Critical spheres and hemicylinders are related by:

$$r_s = \frac{(r_{hc} + \lambda_{hc})(h_{hc} + 2\lambda_{hc})}{1.2198(h_{hc} + 2\lambda_{hc}) + (r_{hc} + \lambda_{hc})} - \lambda_s$$

ShapeB_g²

Elliptic Cylinder*

The buckling equation for a right elliptic cylinder is of the form:

$$B_g^2 = B_z^2 + B_e^2 = (\pi/L)^2 + B_e^2(m, M)$$

where L is the cylinder height, m is the semi-minor axis and M is the semi-major axis (extrapolated dimensions).

The solution of elliptical buckling, B_e^2 , takes the form:

$$B_e^2 = K(c^2)/m^2 \text{ where } c = M/m \text{ and } K(c^2) \text{ is a function which varies with } c^2$$

Values of $K(c^2)$ can be determined from the accompanying table. Interpolation between points can be determined by the approximate formula:

$$K(c^2) = K(c_2^2)(c_2^2/c^2)(c - c_1^2)/(c_2^2 - c_1^2)^2$$

$$+ K(c_1^2)(c_1^2/c^2)[1 - (c^2 - c_1^2)/(c_2^2 - c_1^2)]$$

where $c_1 < c < c_2$

<u>c</u>	<u>K(c²)</u>	<u>c</u>	<u>K(c²)</u>	<u>c</u>	<u>K(c²)</u>	<u>c</u>	<u>K(c²)</u>
1.0000	5.7832	1.2437	4.7549	1.5003	4.1576	1.7460	3.8074
1.0174	5.6849	1.2634	4.6961	1.5198	4.1239	1.7643	3.7869
1.0352	5.5898	1.2832	4.6308	1.5341	4.0915	1.8094	3.7384
1.0531	5.4983	1.3030	4.5860	1.5583	4.0603	1.8538	3.6940
1.0714	5.4100	1.3228	4.5344	1.5775	4.0303	1.8974	3.6528
1.0899	5.3249	1.3427	4.4851	1.5968	4.0018	1.9406	3.6152
1.1086	5.2431	1.3624	4.4378	1.6157	3.9741	1.9831	3.5804
1.1274	5.1642	1.3822	4.3925	1.6345	3.9475	2.0241	3.5518
1.1465	5.0886	1.4021	4.3490	1.6534	3.9220	2.0617	3.2024
1.1657	5.0162	1.4217	4.3075	1.6722	3.8973	3.0081	3.1059
1.1851	4.9469	1.4415	4.2676	1.6907	3.8737	3.8181	2.9459
1.2055	4.8801	1.4612	4.2292	1.7095	3.8507	5.0892	2.8112
1.2261	4.8161	1.4808	4.1926	1.7277	3.8284	6.093	2.7681
						∞	2.4674

* P. F. Gast and A. Bournia, Nucleonics, April, 1956.